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(71)(72) Applicants and Inventors: RUSSO, Gianni [IT/IT]; Via A. Sciesa, 10, I-37122 Verona (IT). FULGERI, Ugo [IT/IT]; Via Toscanini, 295, I-41100 Modena (IT).

(74) Agent: GARDI, Giuliano; Gardipatent, Via Giardini, 605 - Palazzo Prora, I-41100 Modena (IT).

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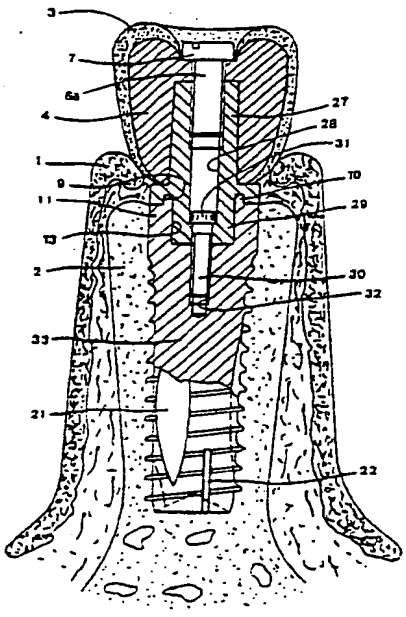

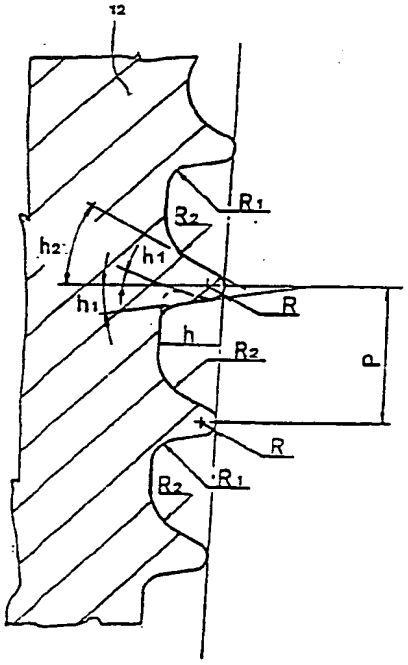

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(57) Abstract

The endosteal dental implant, designed to bring about a drastic reduction in the interim period between insertion of the screw into the jaw bone and anchorage of the prosthesis (3, 4, 5), consists in an asymmetrical frustoconical screw (12) of which the leading thread flank is the steeper in relation to a line normal to the axis so that pressure is less under masticatory load: the body of the screw affords peripheral grooves or recesses (21) of lenticular outline, long though shallow, of which the maximum overall width is some 50 % of the circumference of the screw.

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Screw type endosteal dental implant.

The invention relates to a screw type endosteal dental implant, that is, an artificial dental element consisting in a metal insert screwed into a jaw bone, to which a prosthesis is anchored.

The prior art embraces implants in which the prosthesis is anchored to a screw below driven into the jaw bone, the screw coupling between the metal insert and the jaw bone being prepared through the agency of a thread cutting tool utilizing a key fitted to a shank of internal or external hexagonal profile afforded by the topmost part of the tool; the screw of the implant in any event affording a conventional thread of symmetrical profile; traditional screw implants being provided at the bottom end of the screw with tight, deep slots into which new bone can grow. Such implants required a long interim period between the step of insertion in the jaw bone and that of fitting the prosthesis, for example as long as 6 - 8 months, so as to allow new bone to grow into and fill the slots, thereby stabilizing the implant prior to the application of the prosthesis in view of the notable stresses transmitted to the implant during mastication, in order to avoid its collapse.

In addition, if new bone grows irregularly into the spaces existing between the adjacent crests of the screw thread the implant may be pushed toward the outside and destabilized.

Furthermore, the stresses transmitted to the implant during mastication give rise to components of stress acting on the jaw bone in a direction perpendicular to the axis of the implant, which may damage the bone and compromise the stability of the implant.

There are also implants having a cylindrical insert coated with hydroxyapatites which favour the growth of new bone, although implants of this type afford a very little degree

of retention.

The prior art stands in need of further improvement with regard to the possibility of bringing about a drastic reduction in the interim period, down to 2 or 3 months or even less, avoiding destabiliztion of the implant during said interim period because of asimmetrical growth of the jaw bone and greatly reducing or even eliminating any stress in a direction perpendicular to the axis of the implant, transmitted to the jaw bone during mastication.

From the foregoing, the need will be discerned for a solution to the problem of providing an endosteal dental implant of which the screw thread affords a profile capable of self-tapping insertion into the jaw bone and stabilizing in a short time, said profile being able to prevent the new bone growing between adjacent crests of the profile from pushing the implant toward the outside and to greatly reduce or even eliminate any stress on the jaw bone in a direction perpendicular to the axis of the implant, during mastication.

The aforementioned problem is overcome according to the invention through the adoption of an endosteal implant that consists in a preferably frustoconical screw with a thread of asymmetrical profile: advantageously, the screw presents grooves or recesses of lenticular outline with a longitudinally disposed greater axis, distributed peripherally along the intermediate part of the body of the screw and having a depth of modest value gradually increasing from the outline inwards: the maximum aggregate width of the lenticular grooves or recesses being limited to 50% of the circumference of the thread or thereabouts; terminal grooves or recesses preferably being associated and intercalated with the grooves or recesses of lenticular outline, also of gradually increasing and modest depth.

The advantages obtained with the invention are: broader seating of the thread under the thrust of the masticatory

load and therefore reduced pressure on the jaw bone; reduction or even elimination of the stresses on the jaw bone in a direction perpendicular to the axis of the implant; a considerably shorter interim period; a complete self-tapping action with less removal of bone tissue, and with less pressure on the walls; a consequently lesser degree of bone lesion; a swifter arrival in the growth of new bone at the inner surface of the slot and distribution of the new growth over a greater surface spread over a circumference of greater diameter; the absence of any thrust toward the ouside exerted by the new bone on the implant during its growth.

A number of possible embodiments of the invention are illustrated by way of example in the seven accompanying sheets of drawings, in which: fig 1 is a vertical cross section through a gum with the endosteal implant according to the invention inserted; fig 2 is a section as in fig 1 also showing a section of the prosthetic part of the implant; fig 3 is a section limited to the top part of the gum and the implant, illustrating the intermediate step of protection prior to suture; fig 4 is the horizontal section through IV-IV in fig 3; figs 5, 6 and 7 are the respective horizontal sections through V-V, VI-VI, VII-VII, illustrating the implant only; fig 8 is a partial and enlarged section of one side of the implant, illustrating the thread profile; fig 9 is a section as in fig 1, showining an embodiment particularly suitable for incisors and canines, i.e. of reduced thickness;

fig 10 is a partial section similar to those of figs 1 and 2, illustrating an alternative method of fixing the prosthetic post.

In the drawings, 1 denotes the gum enveloping the alveolar bone 2 of the jaw; 3 denotes the crown covering a tooth 4 fitted over a post 5 tapered gently toward the top and affording a blind threaded axial hole 6 uppermost, which is fixed to the tooth by way of a screw 6a driven into the

tapped hole 6; 7 denotes the head of the screw. The post exhibits a hollow cylindrical base 8 affording a socket 9 at bottom positively engaging a collar 10 of reduced diameter extending from the topmost cylindrical portion 11 of the frustoconical screw 12 of the implant. 13 denotes a socket of prismatic profile, advantageously hexagonal, destined to receive a matching prismatic shank 14 of the post 5 which is extended as a cylindrical element 15 insertable into an axial bore 16 afforded by the screw 12. 17 denotes a topmost cylindrical portion of the bore 16, which is threaded to accept a screw 18 (fig 3) with a countersunk head 19 insertable into the topmost portion 11 of the frustoconical screw 12 to the end of securing an annular cap 20 fitted to the collar 10 for the duration of the interim period allowed for stabilization of the screw 12.

G denotes the topmost part of the gum 1 when newly grown or healed. 21 denotes one of a plurality of grooves or recesses, advantageously three in number, exhibiting a lenticular outline, distributed over the external surface of the frustoconical screw 12 and breaking up the relative thread, serving to accommodate the growth of bone trabeculae and prevent movement of the screw thereafter; 22 denotes one of a plurality of grooves or recesses with parallel flanks formed in the endmost portion of the screw 12 and serving to prevent its rotation. A denotes the diameter of the topmost cylindrical portion of the frustoconical screw 12, which is between 3,2 mm and 6 mm approx; B the mean diameter of the post 5, between 2,7 mm and 4,7 mm approx; C the diameter of the bottom end of the screw, between 3 mm and 5,8 mm approx; and D the diameter of the internal cylindrical element 15, between 1,5 mm and 1,9 mm approx.

CH2 denotes a convenient size of hexagonal key for insertion into the wrench socket 13 of the frustoconical screw 12, advantageously 2 mm.

H denotes the overall length of the insert comprising the frustoconical screw 12 of length H1, together with the relative topmost cylindrical portion 11 of length H2 and the collar 10 of length H3, for which the following ranges of values are envisaged:

H = 8,4 - 20,7 mm

H1 = 5,5 - 17,5 mm

H2 = 2,5 mm

H3 = 0,3 - 0,6 mm

M is the overall length of the post 5, approx 8 mm, which comprises the cylindrical base of length M1, approx 1 mm, and the topmost tapered portion of length M2, approx 7 mm; M5 denotes the length of the prismatic shank 14, approx 2,5 mm, and M6 the length of the cylindrical element 15, between 5 and 10 mm approx.

L is the length of the lenticular grooves or recesses 21, between 5 and 14 mm approx, which are 0,5 to 1 mm in depth and of maximum width such that the sum of their widths is no greater than 50% of the thread circumference or thereabouts; L1 denotes the length of the endmost grooves or recesses 22, between 3 and 5 mm approx, which are 1 mm approx in width and of maximum depth 0,6 mm approx.

P (fig 8) is the pitch of the thread afforded by the asymmetrical frustoconical self-tapping screw 12, advantageously 1 mm.

h is the depth of the thread, 0,4 mm approx; h1 the angle of the leading flank of the thread, which is the steeper in relation to the axis, advantageously up to 5° with respect to a line perpendicular to the axis, the gap being wider than the thread wall; h2 is the angle of the shallower flank, advantageously 30° approx with respect to a line perpendicular to the axis; the angle between the flanks of the thread being h1 + h2 or h2 - h1 (this embodiment being shown by dashed line in Fig. 8).

R is the crest radius, 0,1 mm approx; R1 the radius at the root of the steeper flank, 0,3 mm approx; and R2 the

radius at the root of the shallower flank, 0,7 mm approx.
23 (fig 9) denotes a thinner tooth fitted to a post 24 of suitable shape, and 25 and 26 an angled screw and the relative head, by means of which the tooth 23 is secured to the post 24.
27 (fig 10) denotes a post affording a through hole 28 with a bottom terminating portion 29 of reduced diameter and a prismatic external profile, through which to insert a fixing screw 30 with a hexagonal socket head 31 screwed down into the axial bore 32 of a frustoconical screw 33 similar to the screw 12 described above.
The distance between the steeper leading flank and the shallower flank of the adjacent thread (i.e. the thread space) being greater than the thread thickness, measured on a line parallel to the axis and at a distance therefrom corresponding to the mean radius ot the average radius.
The thread space being wide enough to allow a regular growth of the new bone and to define a considerable stress-resistant section for the new bone.
In practical application, the materials, dimensions and details of execution might be different to those described and illustrated while equivalent in terms of the art, without straying from within the bounds of protection afforded to the invention.
Accordingly, in particular, the dimensions and the proportions indicated might be varied in particular instances, albeit in moderation.

CLAIMS

1. Screw type endosteal dental implant, comprising a screw insertable into the jaw bone, having a bottom end provided with grooves and a top end affording a fitting for the post of the prosthesis, characterized in that the screw is self-tapping, with an asymmetrical thread having a leading flank almost perpendicular to the axis of the screw.

2. Implant as in claim 1, wherein said leading flank is steeper than the other flank with respect to the axis of the screw (12).

3. Implant as in claim 2, wherein the distance between said steepr leading flank and the shallower flank of the adjacent thread is greater than the thread thickness.

4. Implant as in claim 1, wherein the screw (12) is frustoconical.

5. Implant as in claim 1, wherein the body of the screw (12) affords grooves or recesses (21) of lenticular outline with the greater axis longitudinally disposed, peripherally distributed, having a depth increasing gradually from the outline inward to reach modest values; the maximum aggregate width of said grooves or recesses of lenticular outline being limited advantageously to within a value some 50% of the circumference of the thread.

6. Implant as in claim 1, wherein the body of the screw (12) affords a prismatic socket (13) uppermost to allow rotation by means of a key.

7. Implant as in claim 6, wherein the post (5) affords a hollow base (8) at bottom aligned and associated with a collar (10) afforded by the top end of the screw (12), and a prismatic shank (14) extending downward from the bottom of the base, positively coupled with the prismatic socket (13), said shank extending downward as a cylindrical element (15) of smaller diameter insertable into an axial bore (16) afforded by the screw; the tooth (4) being anchored to the post by means of a further screw (6a)

insertable into a threaded hole (6) afforded by the post.

8. Implant as in claim 6, wherein the post (5) affords a hollow base (8) at bottom aligned and associated with a collar (10) afforded by the top end of the screw (12), and a prismatic shank (29) extending downward from the bottom of the base, positively coupled with the prismatic socket (13); said post and said shank affording a through hole (28) with a bottom terminating portion (29) of reduced diameter through which to insert a screw (30), with a hexagonal socket head (31), screwed into an axial bore (32) beneath that extends from said prismatic socket into the body of the self-tapping asymmetrical frustoconical screw (12); the topmost portion of said through hole affording a thread into which to insert a screw (6a) by which the tooth (4) is anchored to the post (5).

9. Implant as in claims 1, 3, wherein said screw (12) has advantageously a pitch P = 1 mm and exhibits the following parameters:

- h1, angle of steeper flank, in relation to a line perpendicular to the axis, up to 5° approx;
- h2, angle of shallower flank, in relation to a line perpendicular to the axis, 30° approx;
- h, depth of thread, 0,4 mm approx;
- R1, R2, radii of the two flanks at the root, respectively 0,3 mm and 0,7 mm approx;
- R, crest radius, 0,1 mm approx.

10. Implant as in claim 5, wherein said grooves or recesses (21) of lenticular outline (21) have a length (L) between 5 and 14 mm approx, and a maximum depth between 0,5 and 1,2 mm approx.

11. Implant as in claim 9, wherein the angle between said flanks is equal to the sum of the angle (h2) of the shallower flank and the angle (h1) of the steeper flank.

12. Implant as in claim 9, wherein the angle between said flanks is equal to the difference between the angle (h2) of the shallower flank and the angle (h1) of the steeper flank.

Fig.1

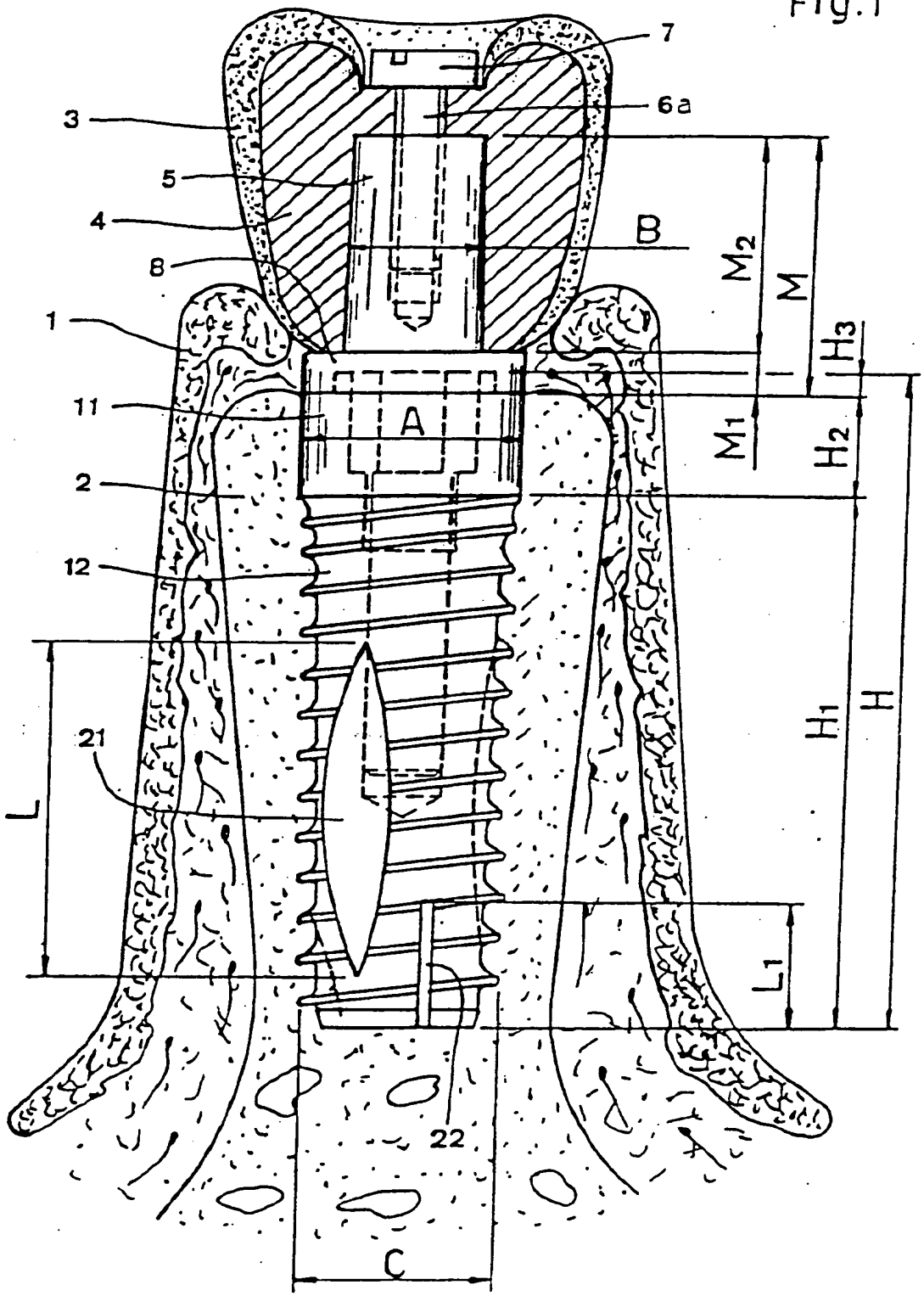
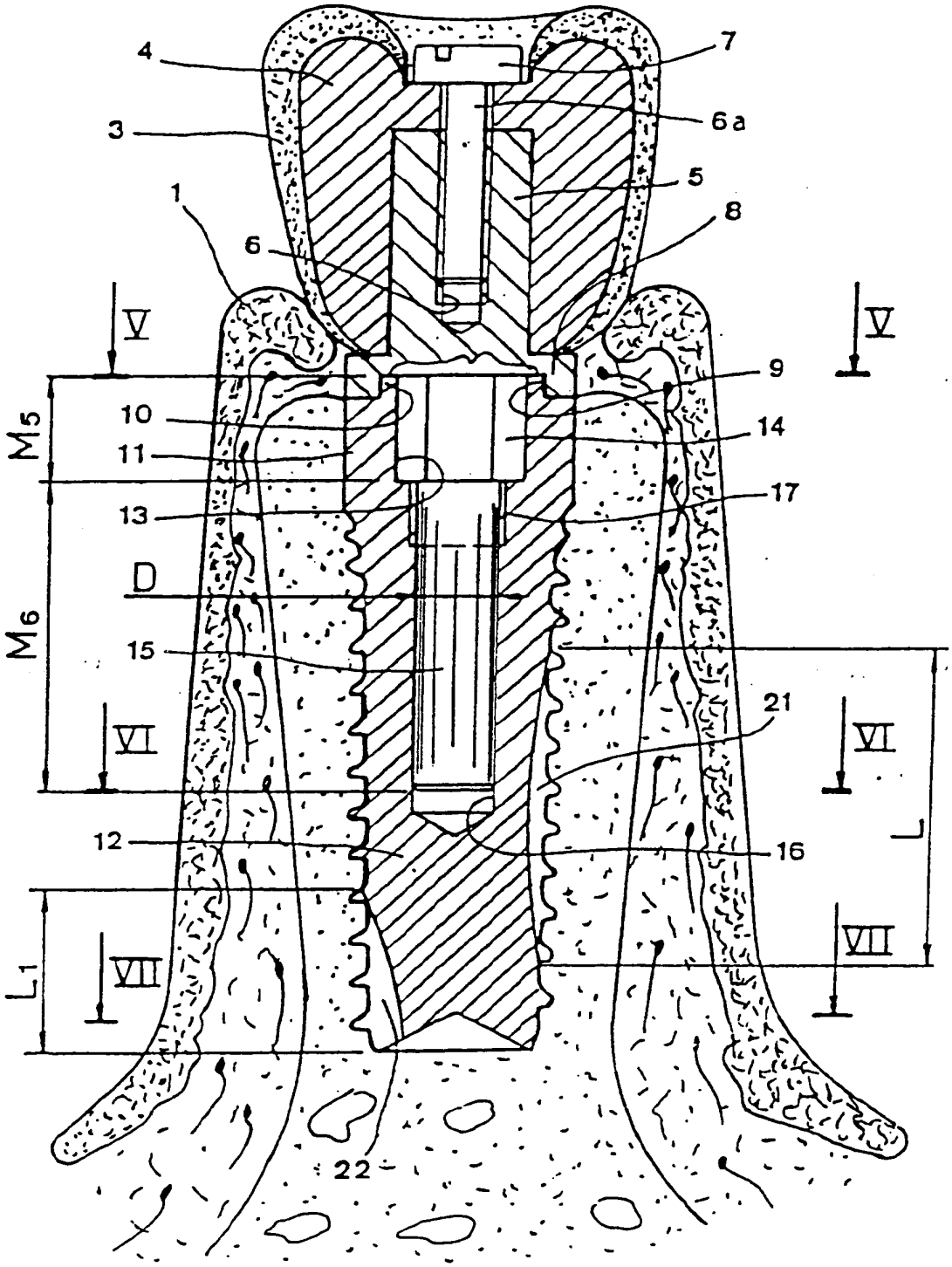


Fig.2


4
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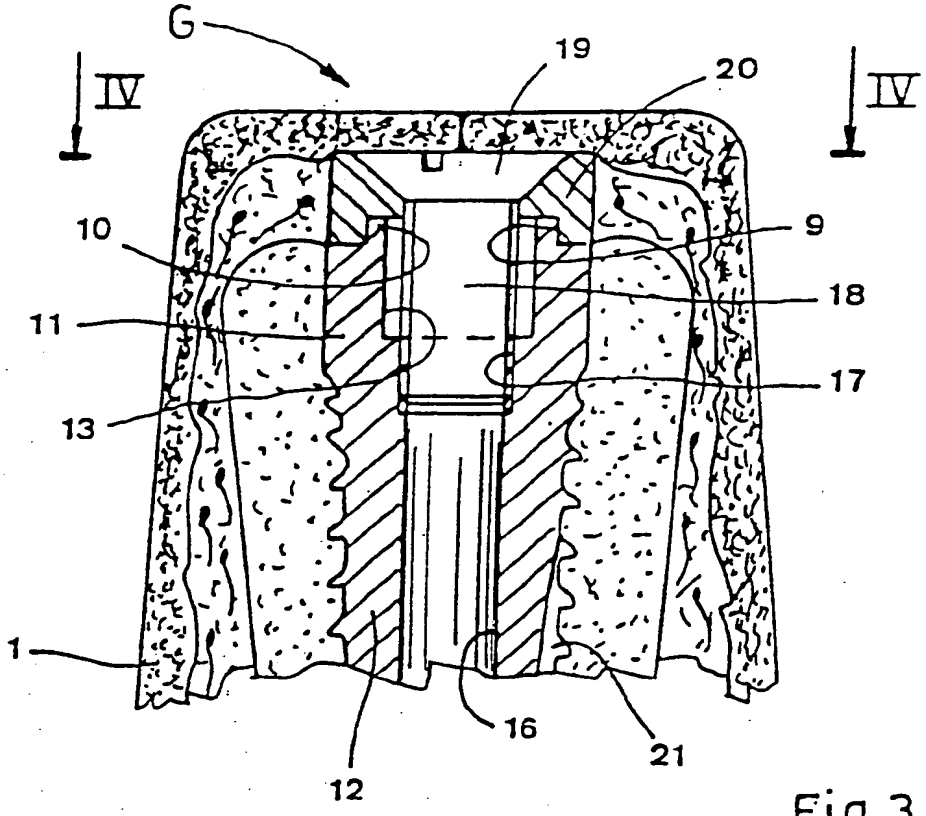
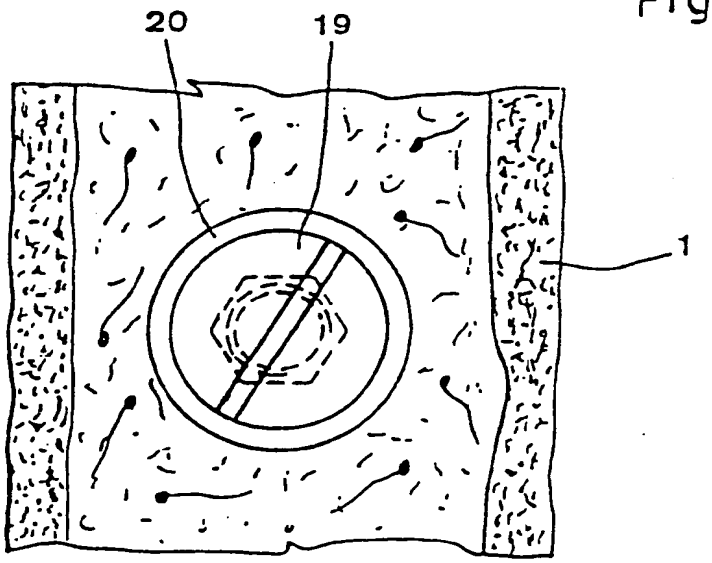


Fig.3

Fig.4



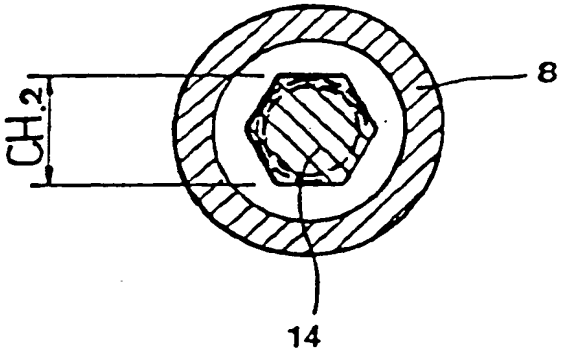


Fig.5

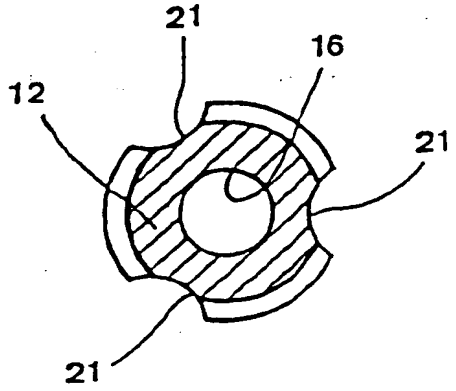


Fig.6

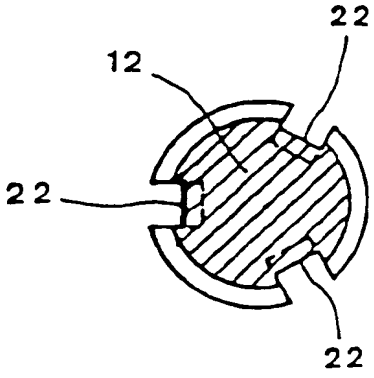


Fig.7

Fig.8

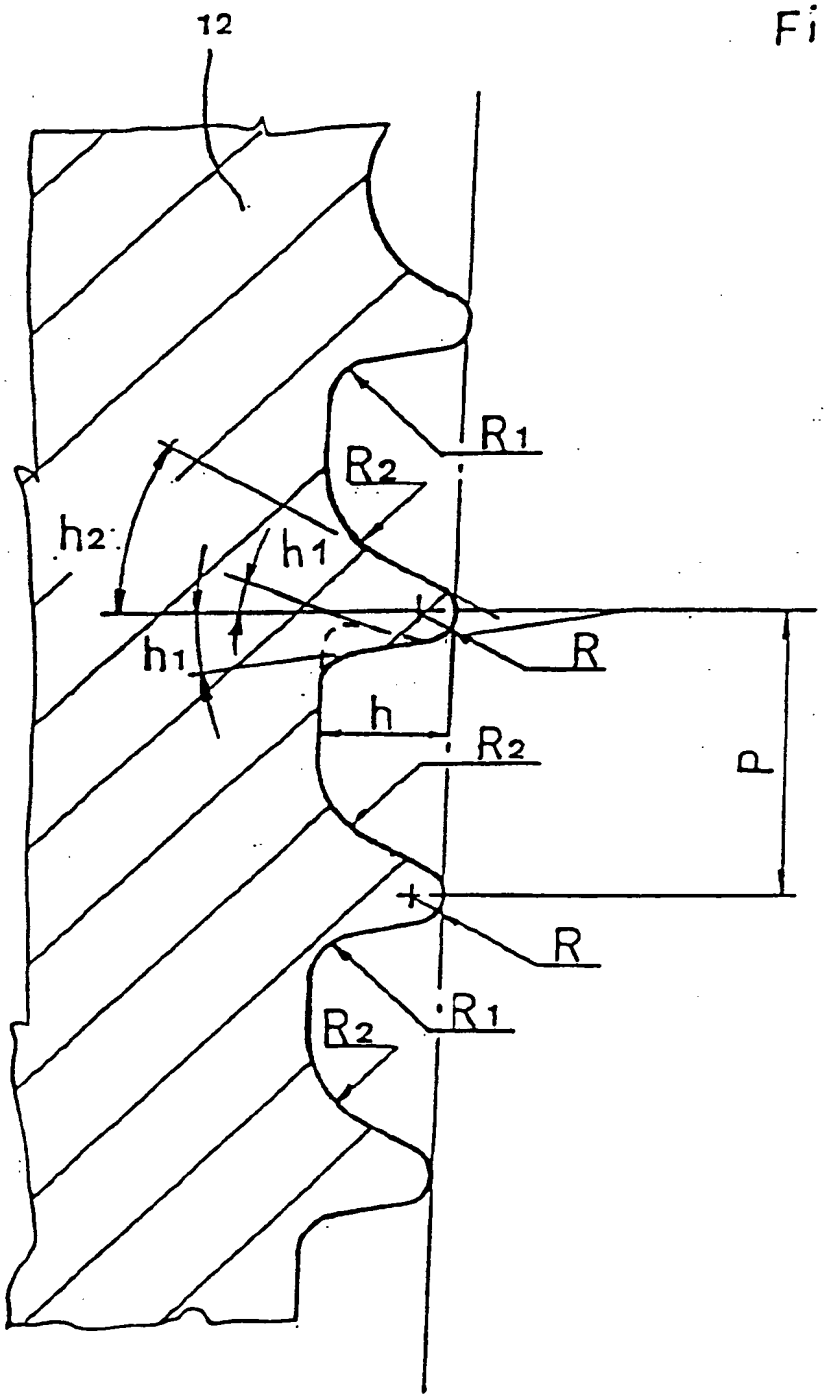


Fig.9

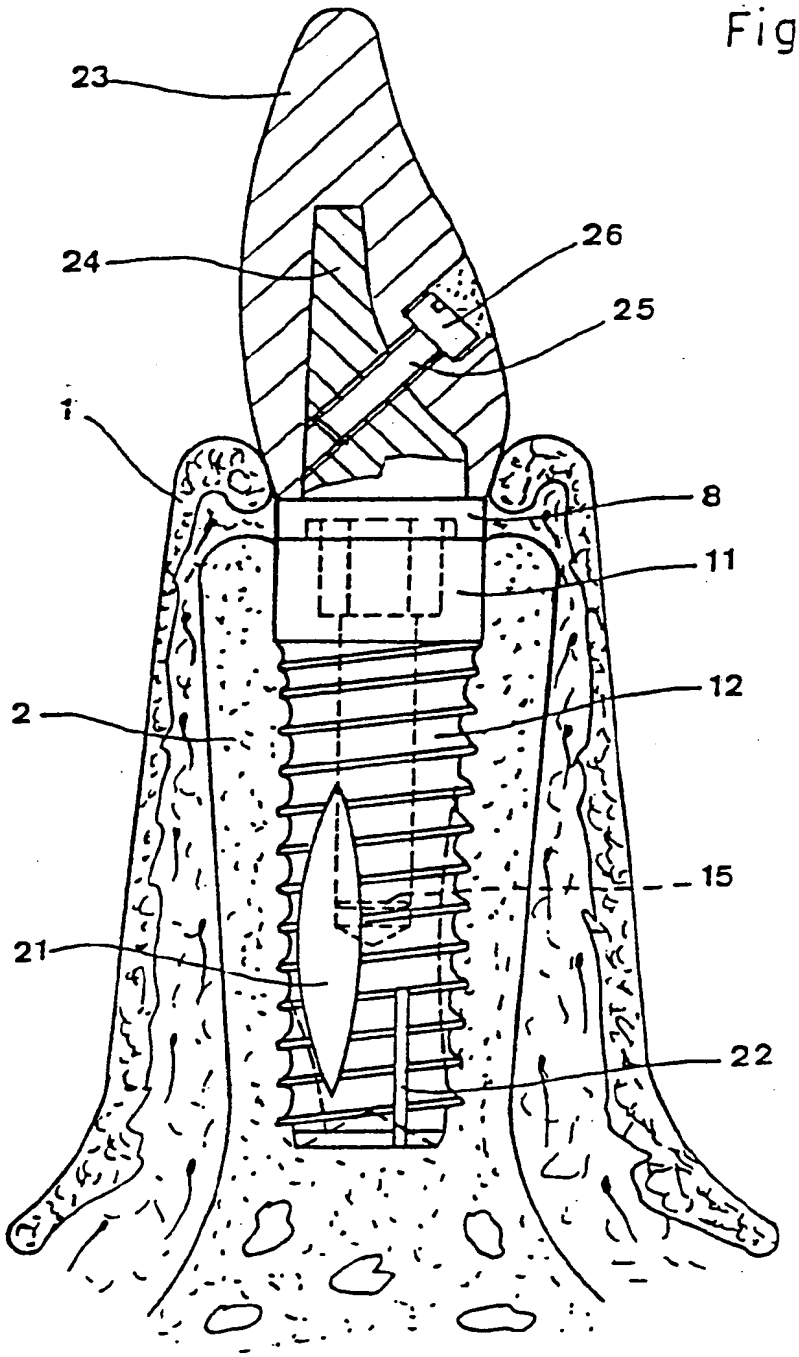
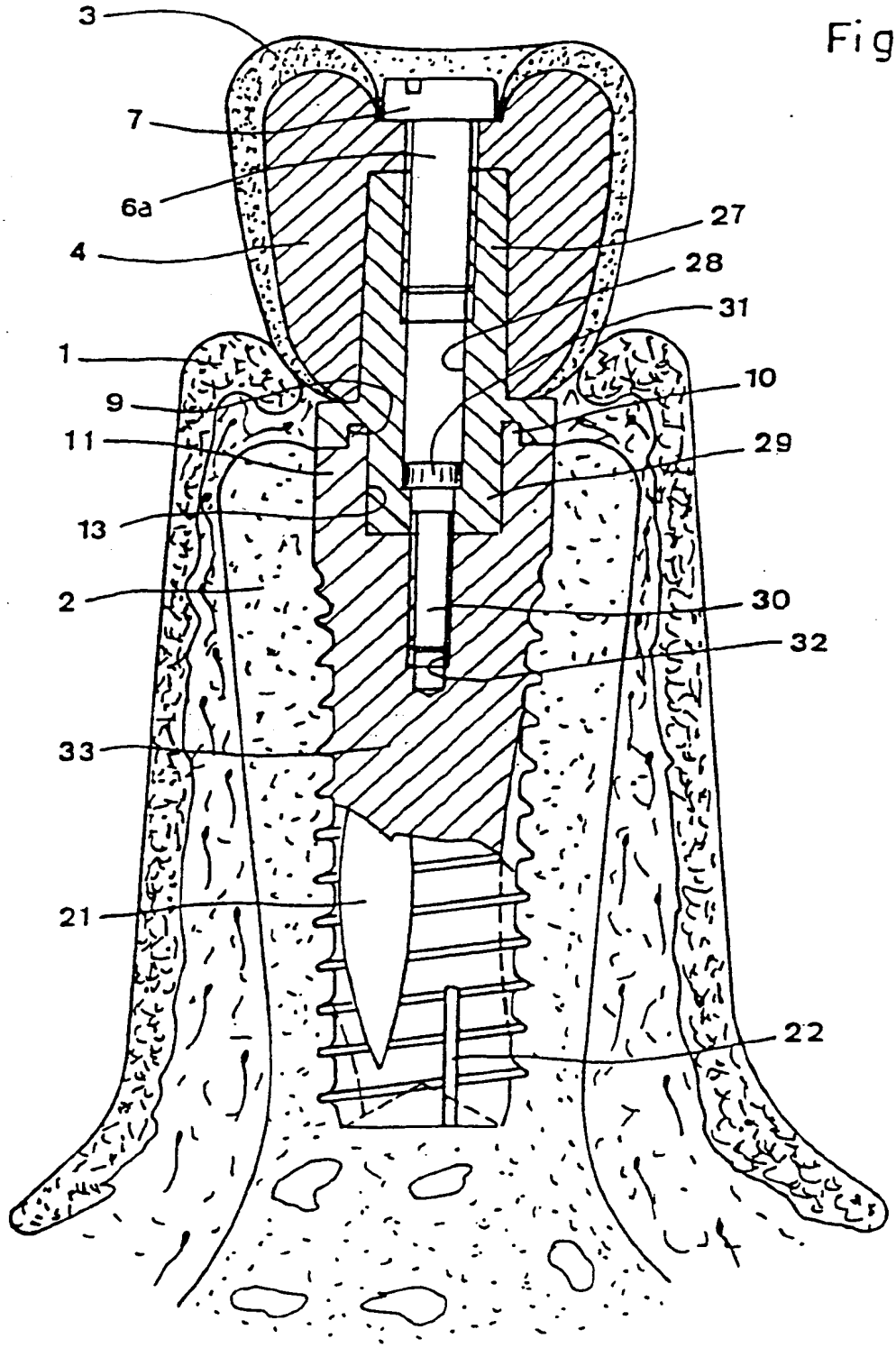


Fig.10



INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 92/02301

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A61C8/00

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	A61C ; A61F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	EP,A,0 282 789 (GRAFELMAN) 21 September 1988 see column 1, line 4 - line 8 see column 3, line 5 - line 7 see column 3, line 15 - line 26; figures 1,4	1-4
X	EP,A,0 263 274 (VENT PLANT) 13 April 1988 see column 2, line 16 - line 21 see column 4, line 51 - column 5, line 32; figures 2-4,11	1-3,6
A		5,7
A	US,A,4 846 683 (LAZZARA) 11 July 1989 see column 2, line 40 - line 52; figure 2	7

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A	MECHANISCHE VERBINDUNGSTECHNIK vol. 14, no. 1, 1990, DUSSELDORF DE page 16 , XP107511 -----	9

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9202301
SA 66456

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